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Five *Lecidea* lichens new to China

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Abstract—Five *Lecidea* lichen taxa—*L. andersonii*, *L. grisella, L. laboriosa*, *L. atrobrunnea* subsp. *saxosa*, *L. atrobrunnea* subsp. *stictica*—are reported for the first time from China.

Keywords—Asia, *Lecidiaceae*, *Lecideales*, saxicolous lichens, taxonomy

Introduction

The lichen genus *Lecidea* Ach. (*Lecideaceae*) was originally described by Acharius (1803). In the sense of Zahlbruckner, the genus once represented one of the largest lichen genera and included about 1200 species (Schmull et al. 2011). Of the 427 species included in *Lecidea* sensu lato (Kirk et al. 2008), only about 100 (all saxicolous) are accepted in *Lecidea* sensu stricto, which is characterized by a *Lecidea*-type ascus (Hertel 2006, Smith et al. 2009).

During our study of lecideoid lichens from China, five *Lecidea* taxa were recognized as new to the country—*L. andersonii, L. grisella, L. laboriosa, L. atrobrunnea* subsp. *saxosa*, and *L. atrobrunnea* subsp. *stictica*.

Materials & methods

The specimens studied are preserved in either the Lichen Section of Botanical Herbarium, Shandong Normal University, Jinan, China (SDNU) or the Kunming Institute of Botany, Chinese Academy of Sciences, Kunming, China (KUN). The

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specimens were examined using standard microscopic techniques and hand-sectioned under a Nikon SMZ 645 dissecting microscope. Anatomical descriptions were based on observations of these preparations under a Nikon EclipseE200 microscope. Sizes cited for the thallus, apothecium, hymenium, and exciple are based on five measurements per specimen. Ascospore dimensions are based on ten measurements per specimen and presented as a range, with outlying values given in parentheses. Secondary metabolites of all the specimens were identified using TLC and solvent C (Orange et al. 2010). Medullas were tested for amyloid reactions using IKI (10% aqueous potassium iodide). Photos of these lichens were taken under Olympus SZX16 and BX61 with DP72.

Taxonomic descriptions

Lecidea andersonii Filson, Muelleria 3(1): 16 (1974). Fig. 1

Thallus often poorly developed, rimose to areolate, angular and usually appressed along rock crevices, whitish to grey; medulla I+ intensively violet-blue; prothallus absent. Apothecia sessile, constricted at the base, round to irregular, (0.4–)1–1.4 mm diam.; disc black, flat to slightly convex, mostly epruinose, rarely with a thin whitish pruina; margin distinct, sometimes becoming flexuose. Exciple hyaline, outer margin dark green to brownish green, 90–150 μm wide; epihymenium dark green; hymenium hyaline, 50–80 μm high; hypothecium brownish, with crystals; paraphyses simple, coherent, with swollen apices. Asci clavate; 8-spored; ascospores narrowly ellipsoid, (8–)9–12 × 3.5–4.4 μm. Pycnidia not observed.

Chemistry—Cortex and medulla K–, C–, KC–. 4-O-demethylplanaic acid was detected by TLC.

Substrate—On siliceous rocks.

Distribution—*Lecidea andersonii* has been reported from Europe and Antarctica (Hertel et al. 2009, Ruprecht et al. 2010). New to China.

Specimens examined: **CHINA**. **Xizang**, Anduo, Mt. Tanggula, alt. 5200 m, on rock, 30 Jul. 2011, Y.L. Cheng 20118836A, 20116422, 20116396, 20116343, 20116395, 20126439 (SDNU); **Xinjiang** Bukang, Mt. Tianshan, alt. 3700 m, on rock, 17 Aug. 2012, L.L. Zhang 20129086, 20129092, 20129135 (SDNU); **Sichuan**, Litang, Mt. Kazila, alt. 4700 m, on rock, 7 Nov. 2008, Z.J. Ren 20080005, 20108491, 20080159 (SDNU).

Comments—*Lecidea andersonii* is morphologically similar to *L. diducens*, also with an endolithic thallus, sessile apothecia, dark green epihymenium, brownish hypothecium, and narrowly ellipsoid ascospores, but *L. diducens* is distinguished by an I– medulla and C+ red exciple and contains 2'-*O*-methylanziaic acid (Inoue 1991).

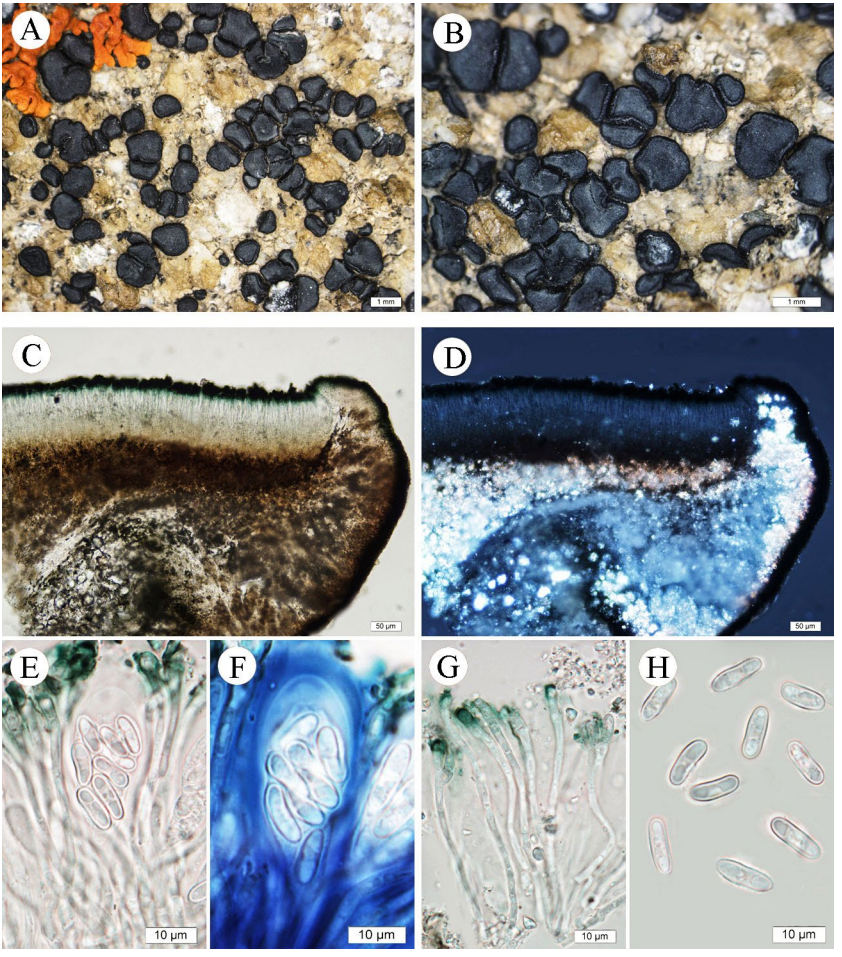

Fig. 1. *Lecidea andersonii* (20129135, SDNU). A: thallus; B: apothecia; C: apothecium section; D: exciple and hypothecium with crystals; E: ascus and ascospores; F: amyloid reaction of ascus; G: paraphyses; H: ascospores.

Lecidea grisella Flörke, Lich. Schlesien: nos 141–142 (1829). Fig. 2

Thallus contiguous, cracked, rimose, rarely areolate, whitish grey to pale grey-brown, generally thicker and never convex; medulla I–; prothallus absent. Apothecia black, immersed, ≤0.6–1.2(–1.5) mm diam., flat to slightly concave; margin distinct, regular. Exciple dark brown, with crystals; epihymenium olive-

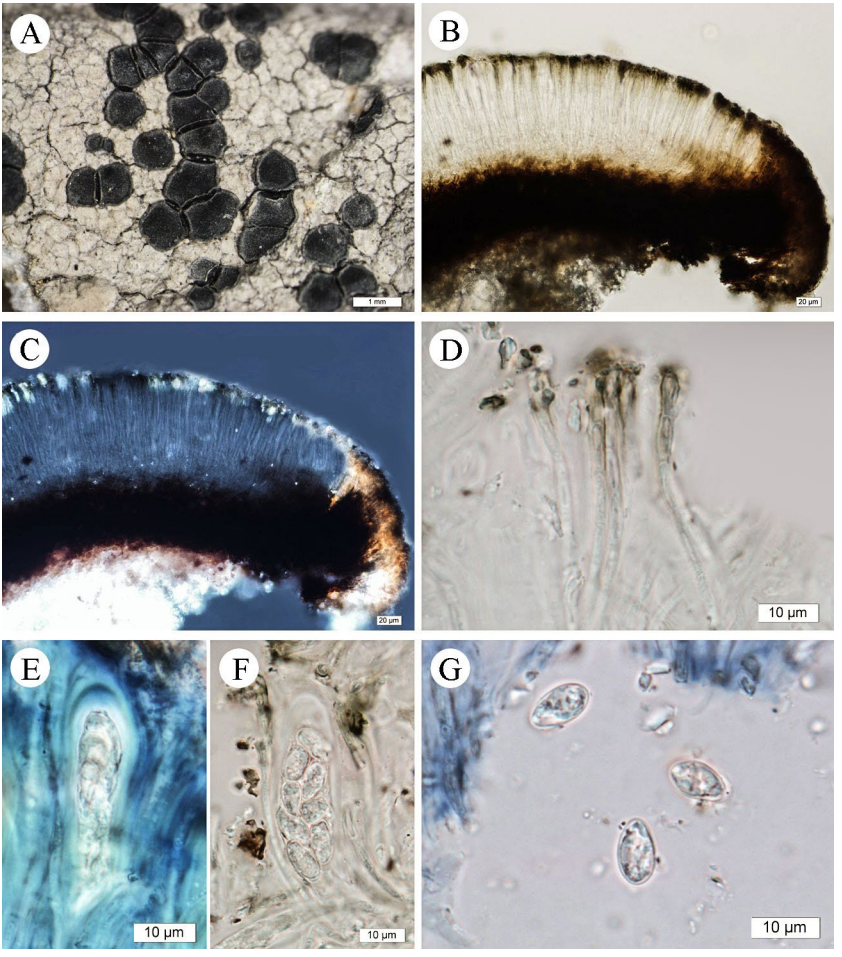

Fig. 2. *Lecidea grisella* (YN182, SDNU). A: thallus; B: apothecium section; C: exciple and hypothecium with crystals; D: paraphyses; E: amyloid reaction of ascus; F: ascus and ascospores; G: ascospores.

brown, with little crystals; hymenium colorless, 60–80 µm; hypothecium dark brown, without crystals; paraphyses 2–3.5 µm thick. Asci clavate; ascospores ellipsoid, simple, 8–12(–13) × 5–6(–7) µm. Pycnidia not observed.

Chemistry—Medulla K–, C+ red, KC+ red; exciple C+ red. Chemical constituent: gyrophoric acid.

Substrate—On siliceous rocks.

Distribution—*Lecidea grisella* has been reported from Asia, Africa, and Europe (Smith et al. 2009). New to China.

Specimens examined: **CHINA**. **Yunnan**, Tangdan, Lanniping, alt. 3800 m, on rocks, 14 May. 2014, W.C. Wang YN222, YN227, YN226, YN225, YN252; L. Hu YN185, YN181, YN182, YN183 (SDNU).

Comments —*Lecidea grisella* is similar to *L. fuscoatra*. The main difference between the two species is visible at the margins: *L. fuscoatra* forms as an areolated thallus on a prothallus, whereas *L. grisella* forms with a continuous thallus that becomes rimose or splits secondarily up into areoles that tend to remain flat with angular edges for a long time (Aptroot & Herk 2007). *Lecidea fuscoatra* occurs on a wider variety of substrata (rather smooth, slightly nutrient-rich siliceous rocks, walls, and brick) and, unlike *L. grisella,* can be found growing on roof tiles and (rarely) on timber (Smith et al. 2009).

Lecidea laboriosa Müll. Arg., Flora 57: 187 (1874). Fig. 3

Thallus endolithic, rarely epilithic; medulla white, I–; prothallus absent. Apothecia black, loosely attached with strongly constricted base, 0.6–1.4 mm diam; disc black, flat to convex, epruinose or faintly pruinose; margin black, persistent, regular to flexuose. Exciple unpigmented or sometimes pale brown, peripherally dark brown, 30–80 µm wide, with crystals; epihymenium black green, olive or brown; hymenium colorless or more rarely with a pale violet tinge, 37.5–60 µm tall, I+ blue; subhymenium colorless, 25–50 µm thick; hypothecium colorless to pale brown, with crystals; paraphyses simple, rarely branched, anastomosed, apical cells 3.5–5 µm wide, globose, with dark caps. Asci clavate, 8-spored; ascospores oblong, 7–11.5 × 2.5–4 µm. Pycnidia not observed.

Chemistry—Cortex and medulla K–, C–, KC–. 4-O-demethylplanaic acid was detected by TLC.

Substrate—on acidic rocks.

Distribution—*Lecidea laboriosa* has been reported from Asia, Europe, and North and South America (Hertel et al. 2009, Nash et al. 2004). New to China.

Specimens examined: **CHINA**. **Xinjiang**, Ursula, Bayingou, alt. 2100 m, on rock, 23 Jul. 2013, C. Chao XL0239 (SDNU); Aletai, Buerjin, Bulanai, alt. 1920 m, on rock, 23 Jul. 2013, Q. Ren 2012607 (SDNU); Yili state, Qiongbola Qapqal national Forest Park, alt. 1861 m, on rock, 12 Jun. 2014, P.M. Wang 20140152 (SDNU); **Sichuan**, Daocheng, Mt. Haizi, alt. 4390 m, on rock, 19 Sep. 2002, L.S. Wang 02–21602 (KUN).

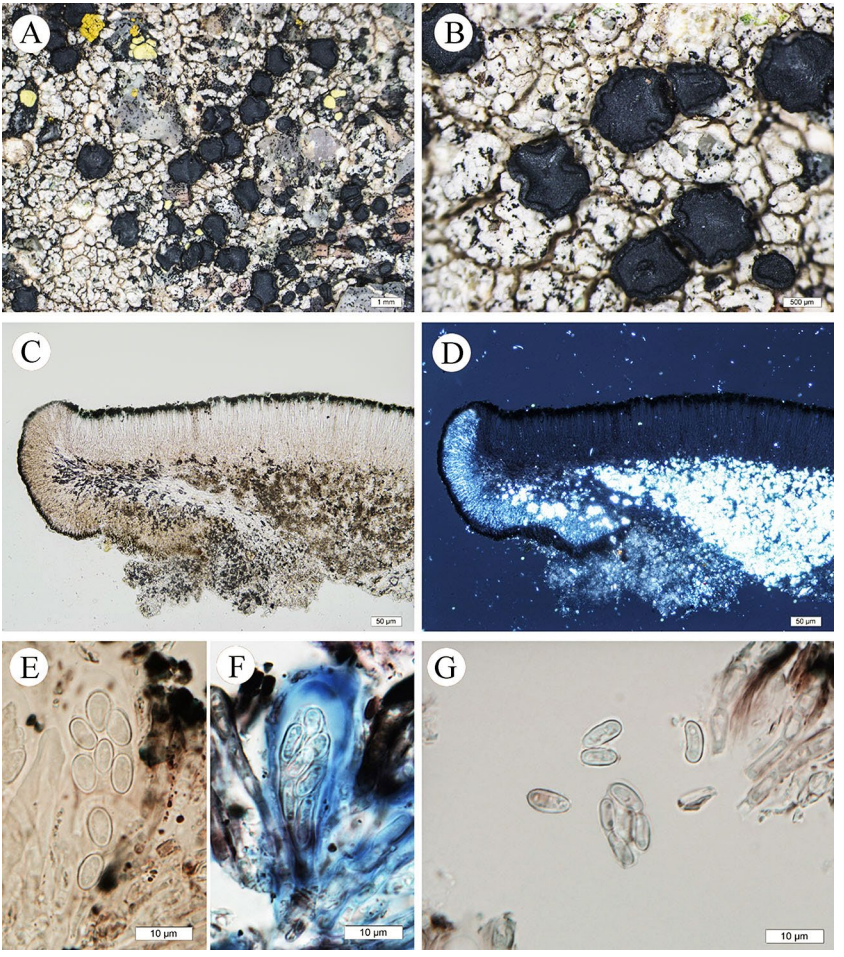

Fig. 3. *Lecidea laboriosa* (2012607, SDNU). A: thallus; B: apothecia; C: apothecium section; D: exciple and hypothecium with crystals; E: ascus and ascospores; F: amyloid reaction of ascus; G: ascospores.

Comments—*Lecidea laboriosa* is morphologically similar to *L. auriculata*, which is distinguished by a K+ red-brown exciple, I+ violet-blue medulla, and the presence of confluentic acid (Nash et al. 2004).

Lecidea atrobrunnea* subsp. *saxosa Hertel & Leuckert,
Lich. Flora Gr. Sonoran Desert Region 2: 296 (2004). Fig. 4

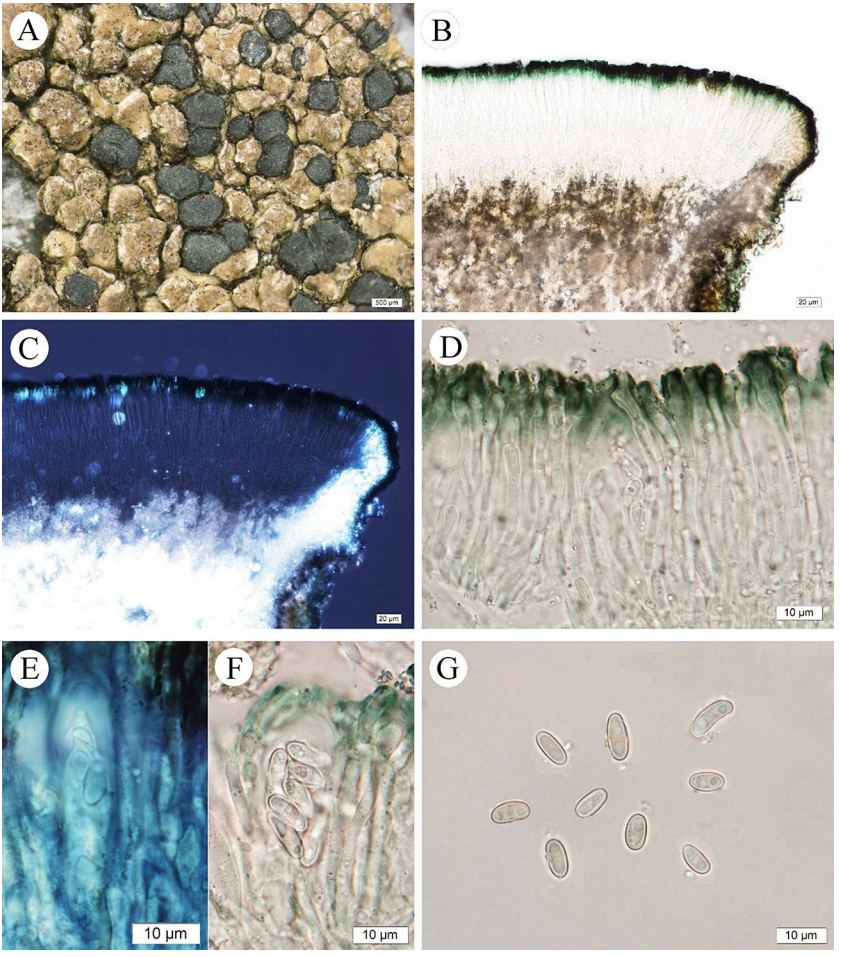

Fig. 4. *Lecidea atrobrunnea* subsp. *saxosa* (20140920, SDNU). A: thallus and apothecia; B: apothecium section; C: exciple and hypothecium with crystals; D: paraphyses; E: amyloid reaction of ascus; F: ascus and ascospores; G: ascospores.

Thallus crustose, bullate to subsquamulose, continuous, brown to dark brown, polished, with an epinecral layer, 5–30 µm, areolate; medulla I+ violet-blue, hypothallus black. Apothecia black, epruinose, ≤1.6 mm diam., adnate, between or partly on the areolae, moderately constricted at the base; with a somewhat prominent margin. Exciple with a greenish black, epihymenium-like rim, unpigmented interior; epihymenium green or olive-green; hymenium

40–60 μm tall; subhymenium hyaline 15–40 μm tall; hypothecium hyaline to pale ochre; paraphyses simple, anastomosing, with swollen apices. Asci clavate, 8-spored; ascospores hyaline, ellipsoid-oblong, simple, 7–10 × 3.5–4 μm. Pycnidia not observed.

Chemistry—Cortex and medulla K+ red, C–, KC–. Norstictic acid was detected by TLC.

Substrate—on siliceous rocks.

Distribution—*Lecidea atrobrunnea* subsp. *saxosa* has been reported from Asia, Europe, North America, and Antarctica (Nash et al. 2004). New to China.

Specimens examined: **CHINA. Xinjiang**, Gongnaisi, Panchen Ditch, alt. 3800 m, on rock, 3 Jul.2014, P.M. Wang 20140675A (SDNU); Hucheng, Kurt, alt. 3700 m, on rock, 12 Jul.2014, P.M. Wang 20140950, 20140920 (SDNU).

Comments—*Lecidea atrobrunnea* subsp. *saxosa* is similar to *L. atrobrunnea* subsp. *atrobrunnea*; but subsp. *saxosa* contains norstictic acid while subsp. *atrobrunnea* contains confluentic acid (Nash et al. 2004).

Lecidea atrobrunnea* subsp. *stictica Hertel & Leuckert,
Lich. Flora Gr. Sonoran Desert Region 2: 297 (2004). Fig. 5

Thallus crustose, bullate to subsquamulose, continuous, brown to dark brown, polished, with an epinecral layer, 5–30 μm, areolate; medulla I+ violet-blue, hypothallus black. Apothecia black, epruinose, ≤1.7(–2.5) mm diam., adnate, between or partly on the areolae, moderately constricted at the base; with somewhat prominent margin. Exciple with a greenish black, epihymenium-like rim, unpigmented inside; epihymenium bright green, olive-green, to green-brown; hymenium 40–60 μm tall; subhymenium hyaline 15–60 μm tall; hypothecium hyaline to medium brown (rarely dark brown); paraphyses simple, anastomosing, with swollen apices. Asci clavate, 8-spored; ascospores hyaline, ellipsoid-oblong, simple, 7–11 × 3–4.5 μm. Pycnidia not observed.

Chemistry—Cortex and medulla K–, C–, KC–. Stictic acid and hypostictic acid was detected by TLC.

Substrate—On siliceous rocks.

Distribution—*Lecidea atrobrunnea* subsp. *stictica* has been reported from Asia, Europe, North America, and Antarctica (Nash et al. 2004). New to China.

Specimens examined: **CHINA. Xinjiang**, Hami, Baishitou, alt. 2800 m, on rock, 28 Jul. 2013, C.Li XL0111 (SDNU); Gongnai, Panchen Ditch, alt. 3800 m, on rock, 3 Jul. 2014, P.M. Wang 20140675B (SDNU).

Comments—*Lecidea atrobrunnea* subsp. *stictica* is morphologically similar to *L. atrobrunnea* subsp. *atrobrunnea* and *L. atrobrunnea* subsp. *saxosa*, but subsp. *stictica* contains stictic acid or hypostictic acid (Nash et al. 2004).

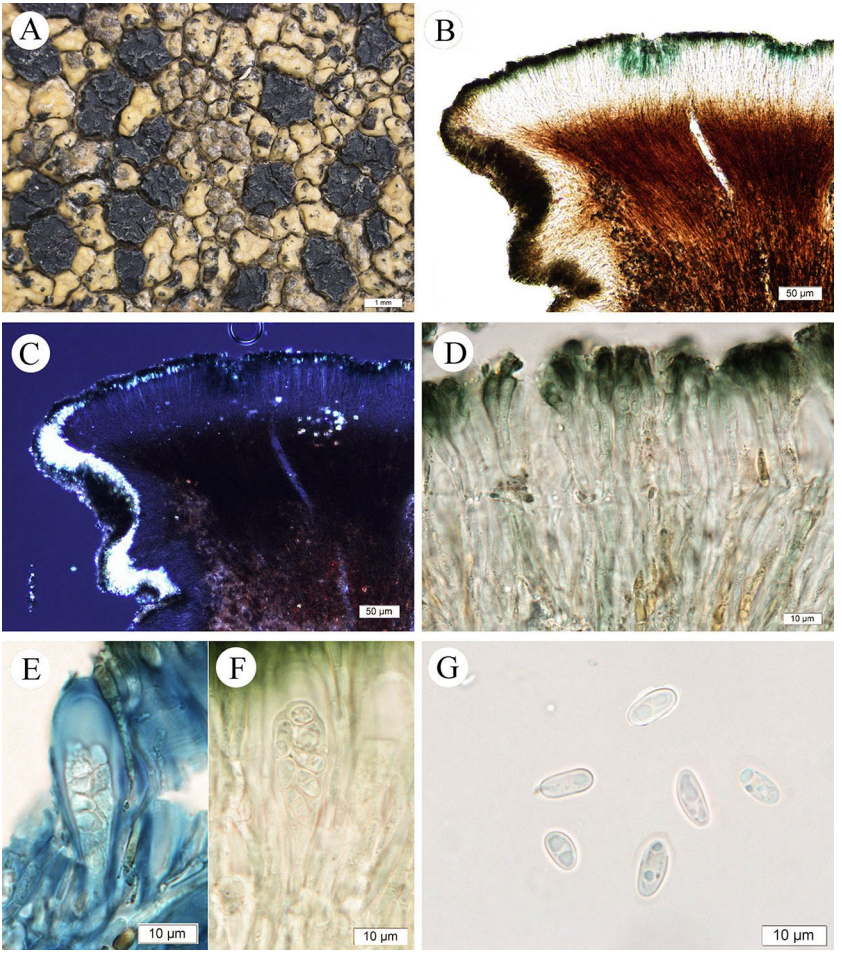

Fig. 5. *Lecidea atrobrunnea* subsp. *stictica* (20140675B, SDNU). A: thallus and apothecia; B: apothecium section; C: exciple with crystals; D: paraphyses; E: amyloid reaction of ascus; F: ascus and ascospores; G: ascospores.

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